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The Manufacturing Confectioner

Research In New Apple Flavors

by FLORENCE B. TALLEY

Eastern Regional Research Laboratory¹, Philadelphia 18

DURING RECENT YEARS several new products have been developed from apples. In exploring their fields of usefulness, it was decided to attempt the production of a truly apple-flavored candy. Prime consideration was given to apple essence, the volatile fraction, since we had found previously that this fraction contributes more to the "typical apple flavor" of products than any other constituent. The essence, prepared by the method of Milleville and Eskew², is a water solution of the volatile flavor ingredients of the juice, 150 times as concentrated as in the juice. Other apple products included in this study were juice concentrate, sirup, nuggets, powder, and pectin.

General Procedure

The general plan of procedure was to incorporate the apple products in each of several types of candy. In this manner we were able to determine which types of candy and which apple products were adaptable to our purpose. A general formula for each type of candy was selected and standardized. Series were then made in which there was only one variable. Four or five batches were included in each series. The variables were: amount of essence and methods of adding it, degree of acidity (amount of citric acid), amounts and kinds of concentrate and methods of addition, use of spices, apple powder, and nuggets, and degree of firmness. Series were also run in which invert or corn syrup was replaced by apple sirup or concentrate.

Each series was submitted to a taste panel of 15 members selected from the laboratory staff, who graded the samples on a scale of 1 to 5. The formula of the sample given the highest score was selected as the final formula.

Gum-Type Candy

It seemed logical to start with gum candy, as fruit flavors are so often associated with this kind of candy.

Pectin, starch and gum arabic were tried as gelling agents. Successful apple candies were made with both

pectin and starch, but it appeared to be impossible to mask the taste of gum arabic completely with the apple flavor.

The pectin gum candy proved to be the best type, because it had the most distinctive fresh apple flavor. It has been an almost universal favorite. One disadvantage, however, was a somewhat limited shelf life. In storage tests, the candy kept well for two or three months. After that, it deteriorated, not so much from a loss of flavor as from the effect of drying out and resulting case-hardening. Proper packaging may prevent this difficulty. Chocolate coating helped to retain the moisture and extend the shelf life. Chocolate, however, especially the semisweet types, tended to mask the apple flavor, although the blend was pleasant.

The starch gum candy had good keeping qualities and was acceptable in flavor, although most people preferred the texture and more readily apparent flavor of the pectin gum candy.

The final formulas worked out for the gum candies are given below.

PECTIN GUM CANDY

10 gm slow-setting pectin*
400 cc water
342 gm sugar
342 gm corn sirup
2 gm sodium citrate
4 gm citric acid
20 cc apple essence (150 F)**
60 gm apple concentrate (78° Brix, de-pectinized)

- 1.—Bring the water to a boil.
- 2.—Mix the pectin thoroughly with approximately $\frac{1}{4}$ of the sugar and add slowly to the boiling water, stirring constantly to avoid lumping.
- 3.—Dissolve the sodium nitrate in a small amount of water, and add to the mixture.
- 4.—Add the corn sirup and the rest of the sugar.
- 5.—Cook to 227-228° F., stirring to prevent scorching.
- 6.—Remove from heat.
- 7.—Combine the apple essence with the apple concentrate and add slowly to the batch. Be sure to mix thoroughly.

¹One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Foundation, United States Department of Agriculture.

²Recovery and Utilization of Natural Apple Flavors, by Howard P. Milleville and Roderick K. Eskew, United States Department of Agriculture, Bureau of Agricultural and Industrial Chemistry, AIC-63, 1944. (Processed.)

*100 grade apple pectin was used. If a stiffer piece is desired, more pectin should be added. A proportionate amount of 100 grade could also be used.

**150 F = 150 times as strong as in the original apple juice.

- 8.—Dissolve citric acid in a small amount of hot water and add to batch, stirring constantly.
- 9.—Turn out on a greased slab.
- 10.—When set, mark in squares and sand with sugar.
- 11.—Dry for a day, or longer if required, at about 80° F. Resanding may be necessary before packing.

STARCH GUM CANDY

- 340 cc water
- 32 gm confectioner's starch, 50-60 fluidity
- 114 gm sugar
- 170 gm corn sirup
- 1.5 gm citric acid
- 10 cc apple essence (150 F)
- 30 gm apple concentrate

- 1.—Mix the sugar and corn sirup with 220 cc of water. Let the mixture come to a boil.
- 2.—Mix the starch with 120 cc of water and add slowly to the boiling sugar mixture.
- 3.—Cook to a medium string.
- 4.—Remove from heat.
- 5.—Dissolve the citric acid in a small amount of hot water and add to the batch.
- 6.—Mix the essence with the concentrate and add to the cooked mixture when it has cooled slightly.
- 7.—Mold in warm starch.
- 8.—Dry until the desired firmness is reached.
- 9.—Steam and dip in sugar.

Fondant-Type Candy

Because of the dilution caused by the addition of the apple essence to the finished product, some difficulty was experienced in getting the fondant to set firm enough to coat. This was overcome by cooking the "bob" sirup to 262-266° F., rather than the customary 237° F. The following formula was finally worked out for the apple fondant:

BASE BATCH

- 240 gm sugar
- 60 gm corn sirup
- 30 gm invert sirup ("Nulomoline")
- 50 cc water

- 1.—Cook to 243° F., washing down all crystals that form on the side of the pan.
- 2.—Cool to 140° F. Cream with beater until the crystals are formed.

"BOB" SIRUP

- 56 gm invert sirup ("Nulomoline")
- 113 gm sugar
- 23 gm water
- 0.5 gm "Convertit"
- 1 gm citric acid
- 25 cc apple essence (150 F)
- 50 gm apple concentrate

- 1.—Mix the invert sirup, sugar, and water.
- 2.—Cook to 266° F.
- 3.—Add the "Convertit," dry citric acid, and the previously creamed fondant.
- 4.—Mix well.
- 5.—Combine the apple concentrate and essence and add to the mixture, mixing thoroughly.
- 6.—Place over hot water to keep fluid.
- 7.—Mold in starch.

Four types of coatings were tried for the fondant: a flavored sweet chocolate, milk chocolate, a fondant coating, and a crystallized coating. The fondant and the crystallized coatings were satisfactory, since they did not interfere with the apple flavor. The milk chocolate also made an excellent blend, but the flavored sweet chocolate, although it made a good blend, masked the

apple flavor considerably. The chocolate-coated apple fondant had an excellent shelf life, retaining the apple flavor after six months or more of storage.

Nougat-Type Candy

The next type of candy tried was the nougat. Such a large quantity of essence was required to make the flavor definitely "apple" that the nougat would not set. To overcome this difficulty, as well as to enhance the apple flavor, apple powder was added. The texture of this candy was satisfactory, but the flavor of the apple powder detracted from the fresh apple flavor. The taste panel felt that it was not sufficiently flavorful to be considered.

Brittle-Type Candy

An attempt was made to produce a "brittle"-type candy having apple nuggets in place of nuts. Apple nuggets are small, extremely crisp pieces of dried apple. However, when they were added to sirup they immediately took up moisture and became tough and rubbery. This also occurred when they were added to gums and nougats.

Marshmallow-Type Candy

At first glance, marshmallows seemed an ideal medium for apple essence, because of the low temperature required for this kind of candy. However, the acidity required to balance the fruit flavor of the essence was not compatible with a marshmallow, and although an apple-flavored marshmallow could be made, it was not well liked.

Caramel, Fudge, and Hard Types of Candy

Caramel and fudge were tried, but they were unsuitable for an apple candy for two reasons: *First*, the ingredients did not blend with the apple flavor. *Second*, the addition of the essence at the end of the cooking decreased the sugar concentration and prevented proper setting. There were also difficulties with hard candy. The addition of sufficient apple essence for flavor made the candy sticky. Then too, the high temperatures required volatilized some of the constituents of the essence.

Summary and Conclusions

In an attempt to develop an apple-flavored candy, various apple products—essence, juice concentrate, sirup, nuggets, powder, and pectin—were incorporated in several types of candy.

The best types for apple candy were pectin and starch gums and fondant. The pectin gum candy was preferred.

Nougat, fudge, caramel, marshmallow, and hard candies were not suitable types for apple candy either because of incompatibility of flavor or because of difficulty in setting.

Apple essence alone did not give a full fruit flavor. It had to be combined with the proper degree of acidity and sweetness and preferably with some concentrated apple juice to give a full apple flavor.

Because of the volatility of the essence, it could not be added directly to the hot batch. Combining it with apple concentrate or any other sirup before adding it cut down volatilization to a large degree.

Invert sirup in a formula could be replaced by apple sirup or apple concentrate, but this served no particular purpose and led to greater difficulty with foaming and scorching.

Of several hundred people who have tried the pectin gum apple candy, some 90 per cent were enthusiastic over it. It is believed that there is a real future for this new confection, and possibly for the fondant type.